ANCIENT MONUMENTS LABORATORY

REPORT
1807

SERIES/No CONSULTANT

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TITLE TREE-RING ANALYSIS OF TIMBERS FROM TWO ROMAN WELLS AT SCOLE, NORFOLK

Tree-ring analysis of timbers from two Roman wells at Scole, Norfolk.

Several associated groups of Roman timbers, particularly from wells where conditions for their preservation and discovery are good, have now been collected from East Anglia, with the aim of establishing a relative framework for the dating of Roman sites until such time as the English tree-ring sequences have been extended far enough back to allow the absolute dating of material from these contexts. The Scole well timbers form a part of this project. A total of fourteen oak timbers from the two wells was analysed dendrochronologically and aspects of their use and processing were studied in addition.

The annual growth rings of many tree species in temperate climates are formed of two parts: a zone of earlywood vessels formed in the spring, which varies little in width and, in oak, consists of between one and four rows of large vessels, and a zone of latewood cells formed throughout the summer which can vary considerably in width. Oak timbers of the Roman period are almost invariably wide-ringed, at least in East Anglia, and were probably selected as a result of the greater strength provided by the high proportion of dense latewood; such wide rings indicate near-optimum growth conditions in terms of climate, soil and lack of competition. In addition, they are usually cut in such a way as to include the minimum number of annual rings - squared trunks or quartered beams which include the pith - instead of the maximum number of rings found on radially split planks. The Scole wood is no exception, and unfortunately these two aspects somewhat reduce its potential for absolute dating.

The nine timbers from Well I consist of four upright corner posts, two braces and three horizontal planks, while of the five from Well II, three were planks, one a post and one a brace (Table 1). The methods of cutting in each group are fairly uniform and seem to represent standard practices for the different

elements of the wells. The upright posts are all quartered beams with some sapwood remaining at one corner (Fig. 1a); they have the greatest number of annual rings with an average of 46. The braces tend to be formed of a complete trunk with some of the sapwood hewn off to give a roughly square cross-section; they form the youngest in terms of numbers of rings with an average of 29 (Fig. 1b). The planks are flat-sawn - that is, the rings run parallel to the long edges of the plank - and they also tend to have some sapwood remaining at one or two corners (Fig. 1c). They fall into the middle group with an average of 39 annual rings. The sapwood preserved in all groups extends up to 21 annual rings.

For the dendrochronological study, thin sections were sawn from each timber and deep-frozen still in their waterlogged state. The surface of one or two radii could then be cut easily with a sharp knife to show up the rings clearly. Since oak is a ring-porous wood, the annual ring boundaries are more easily distinguished than in most other species by the lines of large spring vessels; in all the Scole timbers, there are only one or two vessel rows which suggests the wood could be the sessile oak, Quercus petraea, although the two species are very similar (Huber, Holdheide & Raack, 1941).

The annual rings are measured to the nearest 0.1mm., and the values plotted on translucent two-cycle logarithmic paper, which enables the curves to be compared visually on a light-table. In the case of those with more than forty rings, correlation is also carried out by computer which gives an objective value of similarity to each pair of curves. Agreement is based on the alignment

of significant rings, particularly very narrow ones, and of the overall trend of ring-width, and is facilitated by the presence of sapwood, which,in this case, may be expected to begin in about the same position in each timber. Sapwood also allows an estimate of the felling date to be made, of great value in absolute dating, since it grows at a fairly uniform width of about 20 to 25 years in oak, possibly a little less in this case where the rings are wide.

Three individual curves are shown in their positions of agreement in Fig. 2, with the mean curve for Well I, and Fig. 3 illustrates the mean curve from Well II, of which the first five ring-widths should be disregarded in any correlations since they represent the pith area of only one sample. Fig. 4 shows the relative positions of each sample in the form of a block diagram, where hatching indicates sapwood and the vertical line on the right the estimated felling date.

All the tree-ring sequences from each well were found to match; that is, there is no indication of reuse or repair, except possibly plank E2 which showed no results in the computer analysis but satisfactory visual agreemnnt. Correlation values range from 62.7% to 72.8% with overlaps of between 41 and 51 years, and they indicate that the three uprights from Well I illustrated in Fig. 2, NEC1, SEC1 and SWC1, are likely to have been cut from the same tree, split into four quarters. Thus NWC1 probably forms the fourth quarter, although it had insufficient rings for computer analysis. Values for all three uprights are 72.8% at a 99.9% probability level.

The amount of sapwood remaining seems to indicate an apparent lack of concern over the decay of timber, since it is

much less resistant than heartwood to insect and fungal attack, although in these conditions such attacks may not be of importance. However, it could indicate that the builders were not expecting a very long life-span for the wells, or, more significantly, there may have been a shortage of large oak timber in East Anglia; particularly in Norfolk, woodland seems to have become scarce at an early date and Rackham (1974:64) states that the survival rate of medieval wood is low ~~in Norfolk~~.

When the curves from each well had been correlated, the annual values were averaged to give the mean curves shown in Figs. 2 and 3, the values for which are listed in Table 2, which may form the basis of absolute dating. The 65 year mean curve for Well I shows dating potential when contemporary material becomes available; it shows a degree of sensitivity in the variable pattern of ring widths, such as is necessary in cross-dating. The curve for Well II, of 45 years, may be too short for anything other than tentative dating, since at least 50 and preferably 100 years of overlap with dated material is essential for absolute certainty of correlation. However, although rapid progress is being made, the English tree-ring sequences do not yet extend as far as the Roman period; thus dating may not be possible for several years to come.

Rackham, O. 1974 Oak as a tree in historic times. in The British Oak ed. M.G. Morris & F.H. Perring

Huber, B, Holdheide, W. & Raack, K. 1941 Zur Frage der Unterscheidbarkeit des Holzes von Stiel- und Traubeneiche. Holz als Roh- und Werkstoff 4 (Il) 373-80

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April, 1975

Legends to tables and figures.

Table 1 — Summary of relevant data for the Scole well timbers.

Table 2 — The annual ring widths (0.1mm.) for the mean curves of Wells I and II, comprising 9 and 5 samples respectively.

Fig. 1 — Sketch diagrams of the typical cuts of wood for each of the three elements of the wells; a - upright corner posts, b - braces, c - planks. Cross-hatching indicates the usual distribution of sapwood, the outer area of the trunk.

Fig. 2 — The ring patterns of three individual curves from Well I, SEC 1, SWC 1 and NEC 1 (upright corner posts); their close correlation indicates that they probably originated in the same tree. Below is the mean curve for all 9 samples from Well I. The vertical lines around year 45 mark the boundary between heartwood and sapwood, which has a range of 5 years in the mean curve. The logarithmic scale is in millimetres.

Fig. 3 — The ring pattern of the mean curve from Well II timbers, involving 5 samples. See Fig. 2 for details.

Fig. 4 — Block diagram showing the relative positions of each individual tree-ring sequence after correlation. Open blocks indicate heartwood, sapwood is shown by hatching, and the vertical lines on the right give the felling date estimated from the number of sapwood rings remaining. Note the uniform distribution of the sapwood boundary. The horizontal scale is in years.

Summary of the Scole timbers.

WELL I

No.	No. of rings	No. of sap rings	Radius cms.	Description
NEC 1	52	18	17	Upright corner post
NWC 1	38	6	13	Upright corner post
SWC 1	47	18	14.5	Upright corner post
SEC 1	58	21	15.5	Upright corner post
EB 3	33	10	7	Brace
NB 3	24	19	9.5	Brace
S 3	45	12	20	Plank
E 2	41	-	15	Plank
N 2	39	-	17	Plank

WELL II

NEC 1	35	11	9.5	Upright corner post
EB 3	25	2	6	Brace
E 2	39	6	14	Plank
E 4	39	11	11	Plank
E 5	31	6	13	Plank

Tab. 1

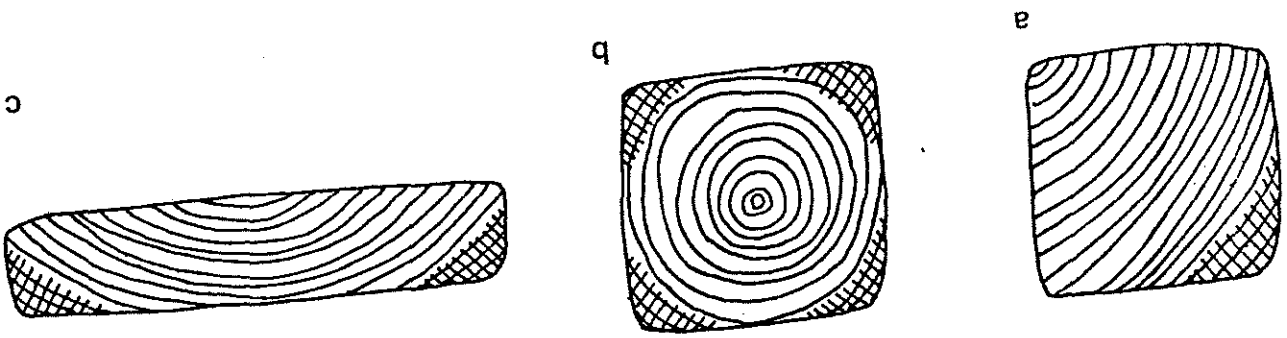
Scole. Mean annual values for the oak curves; 0.1mm.

WELL I 9 samples

	1	2	3	4	5	6	7	8	9	10
1	53.0	48.0	43.0	45.0	44.0	39.5	32.6	36.6	42.3	31.5
11	30.4	27.8	35.5	42.5	37.1	36.6	31.6	35.6	35.6	32.4
21	27.8	32.1	22.0	27.1	22.2	25.2	29.1	29.0	29.2	29.7
31	30.0	41.6	37.4	31.2	32.0	28.0	25.0	30.2	29.2	30.1
41	24.7	25.1	28.7	31.4	21.6	24.9	27.3	19.6	16.5	20.0
51	18.6	19.3	25.8	16.3	19.8	21.4	17.8	21.5	15.5	16.2
61	19.5	32.0	22.0	17.0	32.0					

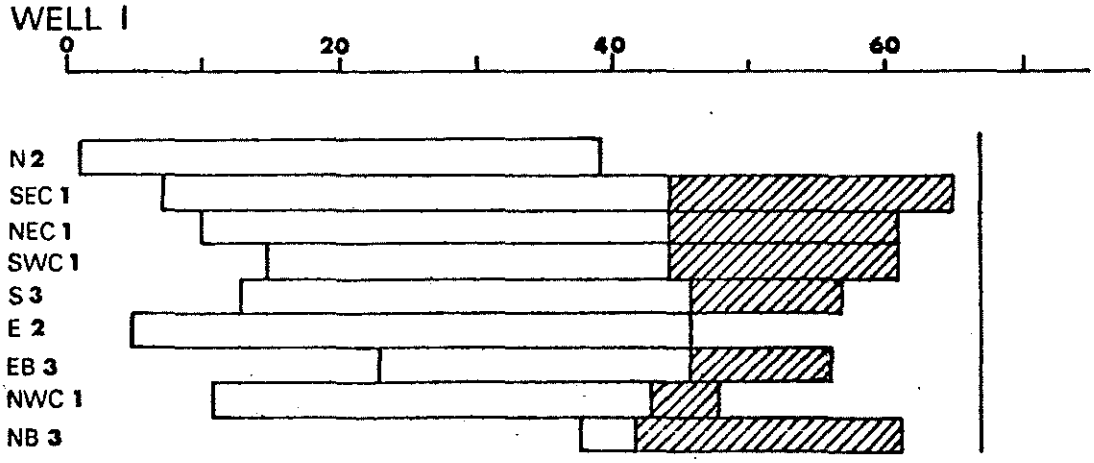
WELL II 5 samples

	1	2	3	4	5	6	7	8	9	10
1	25.0	23.0	37.0	8.0	30.0	30.0	35.6	45.0	44.3	46.3
11	38.2	42.6	45.6	38.6	32.6	27.8	24.4	17.8	27.0	30.0
21	32.4	29.2	27.4	34.4	34.8	32.0	30.8	28.4	29.2	28.2
31	22.0	16.6	17.6	30.8	25.8	32.2	22.6	23.3	16.3	17.5
41	18.5	14.0	12.5	9.5	12.0					



SCOLE

WELL I



WELL II

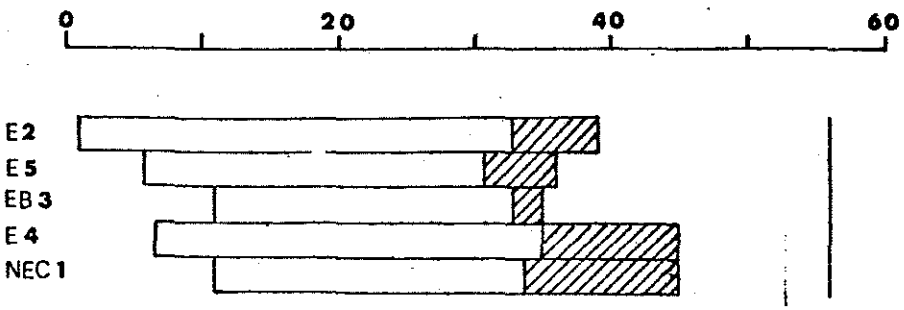


fig. 4.

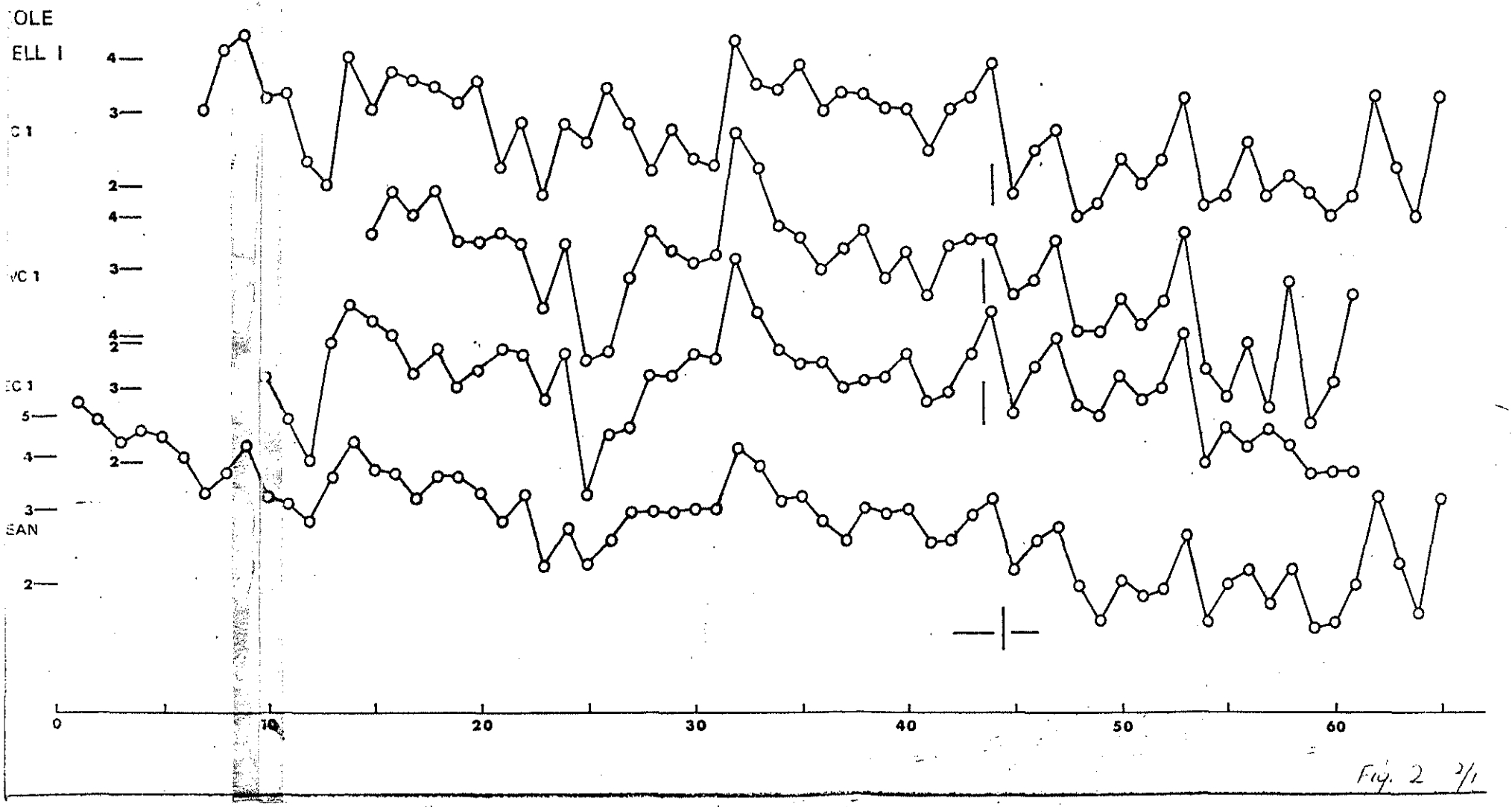


Fig. 2 2/1

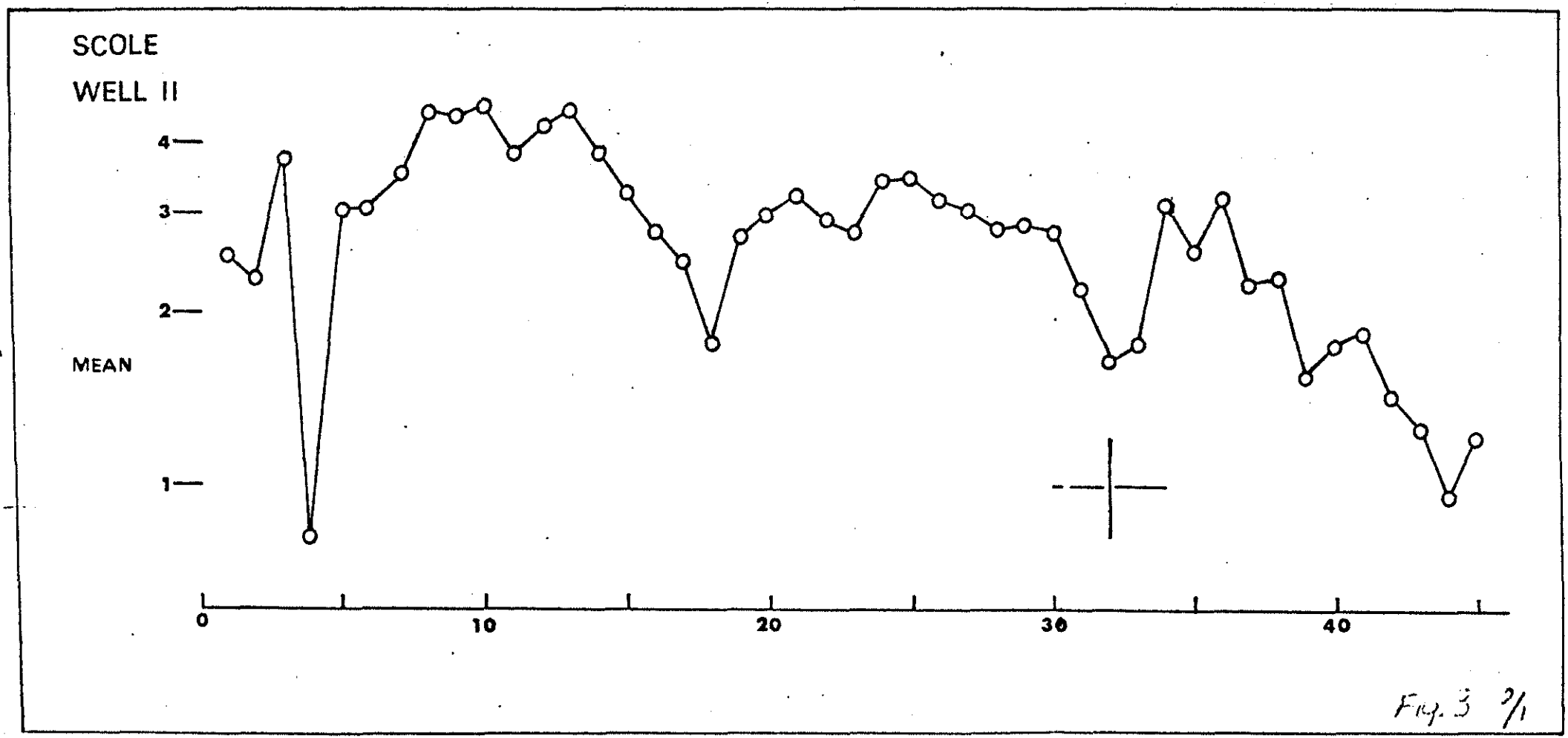


Fig. 3 2/1